of their division; but after this they began to coalesce, though some might be separated from the rest still later. Each of the small cells into which the ovum had divided measured from the 1-1500th to 1-2000th of an inch in diameter, and consisted of a cell-membrane, with several of the minute cells of which the ovum was originally chiefly composed placed like nuclei in its interior (fig. 12). The ovum at the time of its extrusion may perhaps be considered to be a single large cell with a great number of minute cells or nuclei in its interior. During the subdivision of this large cell into a number of smaller cells, I could detect no changes, after repeated examinations, in the form of the minute cells or nuclei, and none in their arrangement which were not apparently produced by the bending inwards of the external or vitelline membrane to effect the subdivision. I do not mean to assert that these central nuclei were not the efficient agents in producing these changes; I only wish to state that I was unable to detect any alteration in the form or in the arrangement of these nuclei preceding these subdivisions. At the end of the sixth day no additional change had taken place in the external form of the ovum, but the cells into which it had divided were continuing to coalesce, and minute cilia were observed on the upper surface of the broad extremity. On the eighth day it had assumed the form represented in fig. 13; its circumference had become somewhat translucent, especially at the lower and middle parts, where the external layer of cells had separated themselves from the others, and coalesced to form the commencement of the shell (fig. 13 *a*). The incipient shell contained many of the minute cells or nuclei, and bands of them passed between different parts of its inner surface and the dark mass in the interior. The cilia on the broad extremity had become larger and more active in their movements, and traces were observed of the division of this end into the *ciliated discs* (fig. 13 *c*) and the *foot* (fig. 13 *d**). The cells into which the ovum had divided had now almost disappeared, while the minute cells or nuclei of which the ovum originally chiefly consists seemed to be as numerous as ever, and were diffused, except where the shell was forming, through a glutinous-looking structureless substance. It is now entitled to the term of *embryo*. Instead of describing in their order of succession the different changes through which the embryo passes until it leaves the case-membrane and swims at large, I shall first describe its structure at that period, as this will save a good deal of repetition, and also render the description more easily followed. Some of the embryos left their *case-membrane* about the end of the fourteenth day after spawning, but the whole had not escaped until three or four

* These parts are indicated by the same letters of reference in a more advanced stage of their development in fig. 17.

days later. The *case-membrane* previous to the escape of the embryo becomes gradually thinner, and at last either entirely disappears or is reduced to shreds. This change in the *case-membrane* may probably be in some measure caused by the incessant strokes of the long cilia of the *ciliated discs* upon its inner surface during the active revolutions of the embryo round its interior. The embryo at the time of its liberation is provided with a shell (figs. 25 and 20 *a*), considerably longer in its antero-posterior than in its transverse diameter, from which it can protrude the upper part of its body and retract it at pleasure. Fig. 20 is a representation of the embryo when protruded from its shell, and fig. 21 when entirely drawn into its interior. The embryo with its shell is at this period considerably larger than the ovum at the time of its extrusion. Some of them measured about 1-145th of an inch in length and 1-200th in the antero-posterior diameter; others 1-170th in the former and 1-250th in the latter direction. The parts which can be protruded from the shell are two large and prominent ciliated discs (fig. 20 *c*), and a projecting process* attached to the upper part of the anterior surface of the body (fig. 20 *d*). The lower surface of this projecting process or *foot* is covered by a hard plate (fig. 20 *g*), which closely adheres to it and moves along with it. The *ciliated discs* are higher in front than behind, and are separated in front by a deep notch and by a shallower one behind. They are very contractile, and present very different appearances at different times; and their superior surface is provided with a thickened margin, to the upper and outer edge of which a row of long and strong cilia is attached, by whose movements they can swim rapidly in various directions through the water. When these discs are elevated and in the vertical position, as represented in figs. 20 and 18, the parts connecting their margins to the body of the embryo are translucent, and they may now be contracted from before backwards and a number of the central cilia collected into a tuft; or if the embryo be about to retire into the shell, they are pressed together, the translucent texture connecting their thickened margins to the body contracts and pulls them downwards, and the *foot* with its hard plate is raised, as is represented in fig. 21. This plate now acts as an imperfect operculum. When the embryo, on the other hand, is about to swim, the *ciliated discs* are thrown apart and flattened, as is represented in figs. 16 and 19; and in this position each disc approaches the circular form, is hollow on the upper surface, and their thickened margins are prolonged inwards along the edges of the anterior notch, at the bottom of which they are continuous.

* To an exactly similar structure in the embryo of the *Asplysia* Van Beneden (Annales des Sciences Naturelles, tom. xv. p. 123, 1841) has given the name of *foot*, and we have here retained the appellation.

In the bottom of this anterior notch, immediately in front of the point where the thickened margins of the discs become continuous, and at the base of the upper surface of the *foot*, the mouth (fig. 16 *y*), which is formed by a simple rounded aperture, is placed. The long cilia attached to the outer edge of the upper surface of the thickened margin of the discs are when at rest first bent inwards at an acute angle as far as the inner edge of the thickened margin, and then project upwards and outwards, but become more straight when in a state of action. The upper surface of the *foot* and the sides of the mouth are provided with cilia considerably smaller than the locomotive ones attached to the margin of the disc, and still smaller cilia are placed upon the hollow upper surface of the discs and other parts of the embryo outside the shell. Two very obvious and transparent cells (figs. 16 and 17 *x*), possessing much more refractive power than the other parts of the embryo, are placed in the base of the foot, at the sides of the gullet and immediately below the mouth. Each of these is apparently inclosed in a larger cell; at least each of them is surrounded by a well-defined ring, which however is more opake than the cell which it encircles (figs. 20 and 21*). From the mouth the gullet leads downward and forwards to the stomach (fig. 20 *h*), and from the back part of the stomach the intestine (fig. 20 *i*) commences. The intestine bends to the right, proceeding upwards on this side, and terminates a little below and behind the right transparent cell in the root of the *foot*, and it is there surrounded by a portion of an irregular mass composed of a few cells (fig. 20 *o*) occupying that position. The whole of the inner surface of the gullet, stomach and intestine is covered with cilia, and in some cases, masses, chiefly composed of what appeared to be minute cells thrown off from the inner surface of the digestive tube, were revolving rapidly in the stomach. Two masses adhered to the lateral surfaces of the stomach and lower part of the gullet (fig. 20 *m* and *n*); one of these, by much the larger (*m*), was placed on the left side, and projected considerably in front of the stomach; the other adhered to its right side (*n*), and was placed immediately in front of the upper part of the intestine. Each of these two bodies was composed of a single cell only, having minute cells or nuclei similar to those originally composing the ovum, scattered over its inner surface with considerable intervals between each. In several cases some minute

* Van Beneden supposes that these transparent cells which he observed in the embryo of the *Asplysia* may be the rudiments of the nervous system. This opinion may be true, but at present it must be considered only in the light of a supposition. These cells, if I mistake not, may be occasionally seen vibrating slightly within the larger cells inclosing them. It has been suggested to me that these may be the rudiments of the auditory organs.